

Hematologic parameters in patients with transient ischemic attack in pre-existing carotid artery stenting

Haematological parameters in patients with transient ischaemic attack

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Abstract

Aim: Carotid artery stenosis is the pathophysiological source of strokes and is an occlusive disease of the carotid artery. Stroke is a disease with high mortality and morbidity. Carotid artery stenosis (CAS) is one of the most important causes of ischemic stroke, and inflammation plays an important role in stroke and carotid atherosclerosis. Many studies conducted in recent years have shown that blood parameters can predict disease progression and mortality in diseases such as stroke and coronary artery disease. Within the framework of this main objective, the relationship between CAS and various hematological parameters in stroke patients was analyzed.

Material and Methods: This study was designed as a monocentric study, in which evaluated demographic and hematological parameters were evaluated in the Firat University Faculty of Medicine, Department of Neurology in Elazig, in Turkey. The sample of the study included 84 participants (CAS Group: 37 and Control Group: 47) who were treated for carotid artery stenosis between September 2018 and March 2020 and were found eligible for suitable with patient inclusion criteria of the study. The age and body mass index of the research sample were recorded, and routine complete blood counts were evaluated.

Results: According to the results, there is not any difference between CAS and control in terms of demographic and clinical features. Another result is that the mean Red cell distribution width (%), Neutrophil and Neutrophil/lymphocyte ratio of CAS group was significantly higher than in the control group, while the Mean corpuscular volume, Lymphocyte, Eosinophils, and Monocytes measures for the control group were significantly higher than in CAS group.

Discussion: The study results suggest that it may be a cheap and useful biomarker in predicting the development of Transient Ischemic Attack (TIA) in patients with stenting of the carotid arteries, since the ratio of neutrophils and lymphocytes in patients with stenting of the carotid artery and developed TIA differ significantly from hematological parameters.

Keywords

Carotid Artery Stenting, Transient Ischemic Attack (TIA), Neutrophil Lymphocyte Ratio

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Introduction

The human brain is a remarkable organ that consumes a significant proportion of the body's basic resources, even though it accounts for about 2 % per cent of the body's total weight. The brain requires about 15 per cent% of the body's total heart rate, 20 per cent% of the body's total oxygen supply, 25-30 per cent% of the body's total glucose consumption, and represents about 30 per cent% of the body's total energy consumption [1]. While a 20-second interruption in brain blood supply causes metabolic changes in the brain, after 5 minutes anoxia that can cause irreversible brain damage and cerebral infarction begins [2,3]. Accordingly, it can be said that cerebrovascular diseases are can be said to be an important health problem in elderly populations. Cerebrovascular diseases, by definition, include ischemic and hemorrhagic diseases that occur due to complete or partial, temporary or permanent interruption of blood flow to the brain for a non-traumatic reason or damage to the vessels feeding the brain [4-8].

Cardiac causes account for 20% of ischemic strokes [9]. Cryptogenic strokes make up approximately 30% to 40% of all ischemic strokes [10]. Whether symptomatic or asymptomatic, there is a strong link between cardiac diseases and cerebrovascular diseases [11-13]. In the ejection fraction, every 5% reduction increases the stroke risk by 18% [14]. Control of these common risk factors could also provide a general reduction in vascular diseases. According to a study, a 40% reduction in stroke was achieved with the use of preventive treatments and regulation of risk factors over a 20-year period [15].

Internal carotid artery occlusion is recognized as a notable risk factor for stroke, a leading cause of morbidity and mortality in the United States and worldwide. The vascular dynamics involved in carotid occlusive disease play a pivotal role in the pathogenesis of stroke [16]. Carotid artery stenosis is the cause of 5-12% of strokes occurring in 1 year, but it can also be found asymptotically in 1%. The main goal in the treatment of atherosclerotic carotid artery stenosis is to reduce the risk of transient ischemic attacks and stroke [17].

The Ethiopian study conducted by Fekadu et al. shows that stroke has a significant impact on morbidity and mortality in this country [18]. This low complication and restenosis rates, which emerged with the data obtained from many centers, reveal the positive development in endovascular treatment of carotid artery stenosis.

The risk of stroke can be significantly reduced by identifying risk factors in patients and changing preventable risk factors. Hematological parameters are used quickly, cheaply, and universally, and often assist the responsible physician in the decision-making process in patients with various diseases. Thus, the rapid examination of blood results provides an important advantage for both physicians and patients.

Material and Methods

This study was designed as a monocentric study in which demographic and haematological parameters were evaluated atin the Department of Neurology, Faculty of Medicine, Firat University, Elazığ, Turkey. Ethics committee approval of the study was obtained from Firat University Rectorate Non-

Interventional Research Ethics Committee with the number 2017-07-06:11/14-208463.

The sample of the study was obtained between September 2018 and March 2020. The sample of the study consisted of patients who were treated for carotid artery stenosis and had carotid artery stenting stented to the carotid artery and then applied to the emergency department of our hospital because they hadof an ischemic attack, diagnosed as an ischemic attack with the tests performed and hospitalized in the neurology department of our hospital. The study consisted of 84 participants (CAS gGroup: 37 and cControl gGroup: 47) among the patients who met the inclusion criteria, that is, patients who had previously undergone stenting due to carotid artery stenosis and who were hospitalized and treated in our hospital due to ischaemic attack in the future. Our study includedThe patients who underwent included in our study were patients whose age, body mass index and blood biochemical parameters, radiological images and other additional medical examinations were performed.

Statistical analysis

The methodology of your our research was conducted on two different groups, CAS (Carotid Artery Stenosis) and a cControl gGroup. It was determined that the data did not show normal distribution, a finding confirmed by the Kolmogorov-Smirnov Test. Therefore, instead of using parametric statistical methods, non-parametric statistical methods were preferred due to the nature of the data. Data analysis and comparisons between groups were carried out using the Mann-Whitney U test. These statistical approaches are suitable for situations where the data are not normally distributed and are common methods used to produce reliable results. $P < 0.05$ was considered significant in statistical analyses.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

Patients included in the study were examined in 2 separate groups: the control group and the CAS group.

Table 1 shows the means of demographics and clinical features/futures by groups and the significance of the difference between these mean scores. They were examined by the independent sample t-test/Mann-Whitney U test. According to the p-values of the results, demographics and clinical characteristics did not differ significantly betweenby

Table 1. Demographic and clinical features/futures (mean \pm SD).

Variable	CAS group (n:37)	Control group (n:47)	p value
Age (years)	67.6 \pm 10.8	65.1 \pm 9.3	0.36
Body mass index (kg/m ²)	26.0 \pm 2.8	25.4 \pm 2.8	0.34
Heart rate (beats/min)	81.2 \pm 17.0	82.6 \pm 14.5	0.69
Systolic blood pressure (mmHg)	136 \pm 16.6	136.6 \pm 19.3	0.87
Diastolic blood pressure (mmHg)	75.7 \pm 15.6	77.3 \pm 15.1	0.62
Fasting glucose (mg/dl)	139.9 \pm 37.8	125.1 \pm 32.7	0.06
Total cholesterol (mg/dl)	181.9 \pm 40.3	172.5 \pm 37.7	0.28
HDL-cholesterol (mg/dl)	35.7 \pm 5.5	35.8 \pm 6.6	0.94
LDL-cholesterol (mg/dl)	127.1 \pm 30.1	122.0 \pm 28.3	0.43
Plasma triglyceride (mg/dl)	117.0 \pm 38.1	124.0 \pm 51.6	0.47

Data expressed mean \pm SD or percentage

Table 2. Common blood testcounting parameters.

Variable	CAS group (n:37)	Control group (n:47)	p value	
Hemoglobin (g/dL)	12.4±1.2	12.7±1.7	0.36	
White blood cell count (x10 ⁹ /L)	7.12±2.1	7.58±2.1	0.43	
Platelet count (x10 ⁹ /L)	232.3±68.4	246.5±60.7	0.34	
Hematocrit (%)	42.1±4.6	41.1±4.2	0.34	
Red cell distribution width (%)	14.8±1.5	13.8±1.6	0.01	
Red blood cell count (x 10 ⁶ /mL)	4.70±0.82	4.81±0.80	0.66	
Mean corpuscular volume (fl)	81.8±5.6	84.9±5.7	0.01	
Mean corpuscular hemoglobin (pg)	28.9±2.4	28.6±2.3	0.56	
Mean platelet volume (fl)	9.0±0.8	8.9±1.0	0.42	
Platelet distribution width (%)	15.0±1.8	15.0±1.9	0.98	
White cell distribution (%)	Neutrophil	71.5 ± 5.7	63.7 ± 5.0	<0.001
	Lymphocyte	18.6 ± 4.0	24.9 ± 3.9	<0.001
	Eosinophils	2.1 ± 0.8	2.6 ± 0.5	0.002
	Monocytes	6.6 ± 1.3	7.1 ± 0.8	0.04
Neutrophil/lymphocyte ratio	4.0 ± 1.1	2.6 ± 0.6	<0.001	

groups ($p>0,05$). In other words, there is was no significant difference between CAS and controls in terms of demographics and clinical features/futures.

Table 2 indicates the study groups and the Independent Sample t-test/Mann-Whitney U test results. The mean scores of the complete blood counting parameters determine whether the difference between these scores is significant or not. To this end, red cell distribution width (%) ($p<0,05$), mean corpuscular volume, fl ($p<0,05$), Neutrophil ($p<0,001$), Lymphocyte ($p<0,001$), Eosinophils ($p<0,05$), Monocytes ($p<0,05$), and Neutrophil/lymphocyte ratio ($p<0,001$) showed a significant difference between the groups. In other words, the mean scores of red cell distribution width (%), Neutrophil, and Neutrophil/lymphocyte ratio of CAS group are were significantly higher than in the control group, while the mean scores of corpuscular volume, fl, Lymphocyte, Eosinophils, and Monocytes measures for in the control group are were significantly higher than in the CAS group.

Discussion

Stroke is a major cause of mortality and morbidity. About 75% of ischemic strokes are caused by the anterior system. In 1/3 of them, the cause is carotid artery stenosis (CAD). The CAD-related strokes are at higher risk of recurrence within the first 7 days [19]. Carotid artery stenosis is a serious condition usually caused by atherosclerosis [20].

Many studies have identified a relationship between ischemic stroke and neutrophil/lymphocyte ratio (NLR) levels. It has been found that the mortality of patients with ischemic stroke was directly proportional to the high levels of NLR [21]. Vogelgesang et al. showed that the leukocyte count started to decrease immediately after stroke [21]. Similar results were obtained in our study, and the lymphocyte value was found to be statistically higher in the control group. In the study conducted by Tokgoz et al., they found out that the leukocyte count was lower in patients with a mortal course due to stroke [22]. More studies are needed to show the mortality of leukocyte count in stroke.

In the study conducted by Ionita et al., neutrophil count and plaque characteristics were investigated. While the plaque lipid, macrophage and microvessel density was directly proportional to the number of neutrophils amount, the amount of the plaque collagen and muscle was inversely proportional to showed an inverse proportion with the number/amount of neutrophils [23]. Similarly, the same study showed that the number of neutrophils and the degree of carotid stenosis increased in direct proportion. In the study conducted by Wang et al., it was concluded that NLR is a determinant of all-cause deaths and cardiovascular events [24].

In a study conducted by Koklu et al. in which patients with 50-70% stenosis in the carotid artery were compared symptomatically and asymptotically, symptomatic patients showed that the total neutrophil count and NLR were significantly higher and the total lymphocyte count was significantly lower compared to asymptomatic patients [25]. According to research results, since the ratio of neutrophils and lymphocytes from hematological parameters in patients who develop a transient ischemic attack (TIA) with a carotid artery stent differs significantly, it is believed that it could be a cheap and useful biomarker for predicting the development of TIA in patients who have stents in carotid arteries. However, it is thought that the role of each factor can be revealed separately as a result of the statistical analysis made considering all the reasons that may cause TIA, and it is necessary to study much more patients for finding in-depth results.

Limitations

The major limitations of the present study are a single center experience and may be represented by the small number due to the necessity to exclude patients with hypertension, diabetes mellitus, severe coronary artery disease or valvular heart disease, and patients on medications interfering with autonomic functions. Finally, these conclusions may not extend to the general population; therefore, the results of this study need confirmation in larger studies with the control group.

Conclusion

Since the neutrophil/lymphocyte ratio is significantly different from other haematological parameters, it can be used as a cost-effective and valuable biomarker to predict the development of Transient Ischaemic Attack (TIA) after carotid artery stenting.

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Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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